

NUTRITIONAL STATUS OF SCHOOLCHILDREN FROM MUNICIPAL SCHOOLS IN A CITY OF SAO PAULO, BRAZIL

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ABSTRACT

A cross-sectional study was carried out to evaluate the nutritional status of schoolchildren aged 6 to 10 years enrolled in municipal schools in Carapicuíba in 2014. The anthropometric evaluation was performed by weight and height and the classification of the nutritional status by height-for-age, weight for age and body mass index for age expressed in Z-score, compared to the reference values recommended by the World Health Organization. The prevalences in the categories of height, weight and body mass index were analyzed by the chi-squared test and were considered statistically different when $p < 0.05$. Less than 3% of schoolchildren are short or have low birth weight. Comparing boys and girls, no statistically significant differences were found regarding the prevalence of height, weight and body mass index. There was a high prevalence of overweight among schoolchildren in Carapicuíba.

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INTRODUCTION

The city of Carapicuíba, metropolitan region of Sao Paulo, is a dormitory city and, according to the 2010 Census, has a population of 369,584 people, of which 179,284 are men (48.5%) and 190,300 are women (51.5%). Its Municipal Human Development Index (MHDI) is 0.749, which places it in the high MHDI range. Nonetheless, per capita income in the 2010 Census was R\$ 712.78 (IBGE, 2018) (about US\$ 223.00). The dimension that most contributes to the HDI of the municipality is longevity, with an index of 0.842, followed by income, with an index of 0.721 and education with an index of 0.693. Carapicuíba occupies the 562rd position among the 5,565 Brazilian municipalities according to the MHDI (IBGE, 2018), making it suggestive of studies because it is representative of the municipalities with better socio-demographic indicators.

The Censuses of 2000 and 2010 indicated that the population of Carapicuíba grew at an average annual rate of 0.70%, while in Brazil it was 1.01% in the same period. Between 15 and 64 years of age is 71% of its population and 5% are 65 years old or more. Little is known about the child population. In recent decades, developed and developing countries, such as Brazil, have experienced profound changes in public health, especially in relation to the nutritional status of children, from high rates of protein-calorie malnutrition to high rates of overweight (overweight + obesity). These profound changes will have a great future impact, since they are strongly related to overweight in adulthood (Giugliano and Carneiro, 2004). For example, the prevalence of overweight in boys and girls in 1974-1975 was 11% and 9%, respectively, and in 2008-2009 it reached 35%

Table 1. General prevalences in the different categories of Z-scores relative to the anthropometry of schoolchildren from the 6 schools of Carapicuíba, Sao Paulo, Brazil, 2014

	Total	Girls	Boys
N (%)	4,099 (100.0)	2,046 (49.9)	2,053 (50.1)
Height, n (%)	Z ₁ : 111 (2.8)	Z ₁ : 50 (2.4)	Z ₁ : 61 (3.0)
	Z ₂ : 3,739 (91.2)	Z ₂ : 1,855 (90.7)	Z ₂ : 1,884 (91.8)
	Z ₃ : 249 (6.1)	Z ₃ : 141 (6.9)	Z ₃ : 108 (5.3)
Weight, n (%)	Z ₁ : 55 (1.3)	Z ₁ : 30 (1.5)	Z ₁ : 25 (1.2)
	Z ₂ : 3,414 (83.3)	Z ₂ : 1,706 (83.4)	Z ₂ : 1,708 (83.2)
	Z ₃ : 630 (15.4)	Z ₃ : 310 (15.2)	Z ₃ : 320 (15.6)
BMI, n (%)	Z ₁ : 169 (4.1)	Z ₁ : 86 (4.2)	Z ₁ : 83 (4.0)
	Z ₂ : 2,528 (61.7)	Z ₂ : 1,279 (62.5)	Z ₂ : 1,249 (60.8)
	Z ₃ : 512 (12.5)	Z ₃ : 258 (12.6)	Z ₃ : 254 (12.4)
	Z ₄ : 890 (21.7)	Z ₄ : 423 (20.7)	Z ₄ : 467 (22.7)

BMI: body mass index. Z-scores from Height and Weight: Z₁: < -1.881, Z₂: -1.881 to 1.881, Z₃: >1.881. Z-scores from BMI: Z₁: <-1.64, Z₂: -1.64 to <1.04, Z₃: ≥1.04 to <1.64 and Z₄: ≥1.64. There were no statistically significant differences between genders.

and 32%, respectively (IBGE, 2010) being the main epidemiological concern in this age group. Among adults, rates of excess weight exceed 50% in men and women. Anthropometry is the easiest way to assess nutritional status (Miranda *et al.*, 2012), and is widely used in population studies (Sperandio, Sant'Ana, Franceschini and Priore, 2011). Additionally, it is recognized that obesity is one of the main risk factors for non-communicable chronic diseases (DCNT) (Brazil, 2011), such as diseases of the circulatory system, cancers, diabetes mellitus. Obesity in children is also related to sleep apnea, musculoskeletal problems, liver disease, psychosocial disorders, behavioral problems, social isolation, depression, low self-esteem and worsening school performance (Lumeng *et al.*, 2010). In the long run, among individuals who were obese in childhood and adolescence, the number of lost workdays and all-cause mortality increases (Dennys and Styne, 2001). Considering these data, the present study had the objective of evaluating the nutritional status of elementary school students I of municipal schools in Carapicuíba.

MATERIALS AND METHODS

The present study was a cross-sectional and descriptive study focused on the diagnosis of growth (height), development (body weight) and nutritional status (body mass index - BMI). All parents of the 5,677 students enrolled in elementary school I in 2014 in the six municipal schools of Carapicuíba, aged 6 to 10 years were informed in writing about the research. The invitation included the necessary clarifications, the measures and evaluations that would be carried out and, together, the Free and Informed Consent Form (FICF) was sent in two ways. All participants gave their parents' signed FICF. In 2014, the city of Carapicuíba had 28,295 enrollments in Elementary School I, divided into 20,230 (71.4%) in state schools, 5,677 (20.1%) in municipal schools and 2,388 (8.4%) in private schools (Prefeitura Municipal de Carapicuíba, 2014). The sample consisted of 4,099 students enrolled in primary education I, who represent 72.2% and 14.4%, respectively, in the municipal network and in the city. The reasons given by school administrators for the reduced sample size (-1,578 students) included: transfers to other cities or to the private network or state network, data not yet updated in the school database and absence on the day of the evaluations. Additionally, some children refused to gauge the anthropometric measures and there were losses due to data inconsistency.

The data were collected between August and October 2014, by previously trained personnel of the Nutrition course, of the Adventist University Centre of Sao Paulo (UNASP). Measurements of height and body weight were collected on a previously scheduled day and time. The body weight was determined by means of a portable electronic scale with a capacity of 150 kg and a sensitivity of 0.1 kg, and the stature was determined in a stadiometer with a precision of 0.1 cm, according to the recommendations of the World Health Organization (WHO, 1995). The respective percentiles and Z scores for height for age (H/A), weight for age (W/A) and BMI for age (BMI/A) were obtained from WHO Anthro Plus Software 3.0.1 and classified according to the World Health Organization (WHO, 2007). All analyzes were performed using the statistical packages GraphPad Prism, version 6.0, and SPSS, version 22.0, both for Windows. Data normality was tested by the D'Agostino-Pearson method. The comparisons between girls and boys were performed using Student's t test and comparisons between the six different schools through the oneway ANOVA followed by the Tukey test. Prevalences in the categories of height, weight and BMI were analyzed using the chi-squared test. In all cases they were considered statistically different when $p < 0.05$.

RESULTS

The proportion of women and men in the population of Carapicuíba (population: 369,584 people, men: 179,284 or 48.5% of the population) and women: 190,300 or 51.5%). The distributions in the six schools of the Municipality of Carapicuíba were: Argeu (n = 429, 10.5%), Edegar (n = 967, 23.6%), João Hornos (n = 538, 13.1%) (n = 740, 18.1%), Nai Molina (n = 867, 21.2%) and Noemy (n = 558, 13.6%). The mean values of age, height, weight and BMI were: 8.8±1.4 years, 132.5±10.5 cm, 31.6±9.1 kg and 17.7±3.3 kg/m², respectively. Table 1 summarizes the prevalence, by sex, in the different categories related to Z-scores of height, weight and BMI. Less than 3% of schoolchildren are short stature or underweight for age, but more than 9% of them are high in weight for age. According to the BMI, prevalence of overweight exceeded 34%. When comparing the prevalences between boys and girls, no statistically significant differences were found. Figure 1 summarizes the comparisons between the six schools in relation to each measured variable. Only at João Hornos School were girls significantly larger than boys (Figure 1). Figure 2 summarizes the comparisons between the six Schools of data regarding age, height, body weight and BMI of girls and boys.

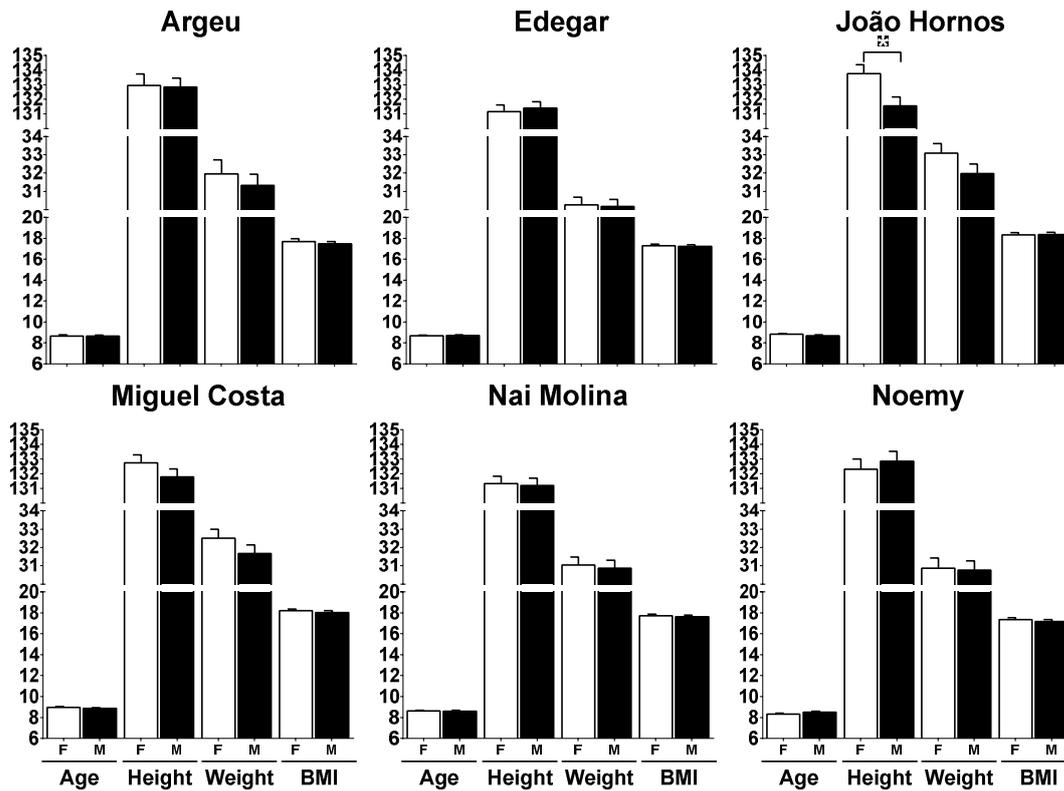


Figure 1. Age, height, weight and BMI of girls (filled bars) and boys (empty bars) within each of the six Public Schools evaluated in the city of Carapicuíba, Sao Paulo, 2014. Values expressed as means ± standard errors

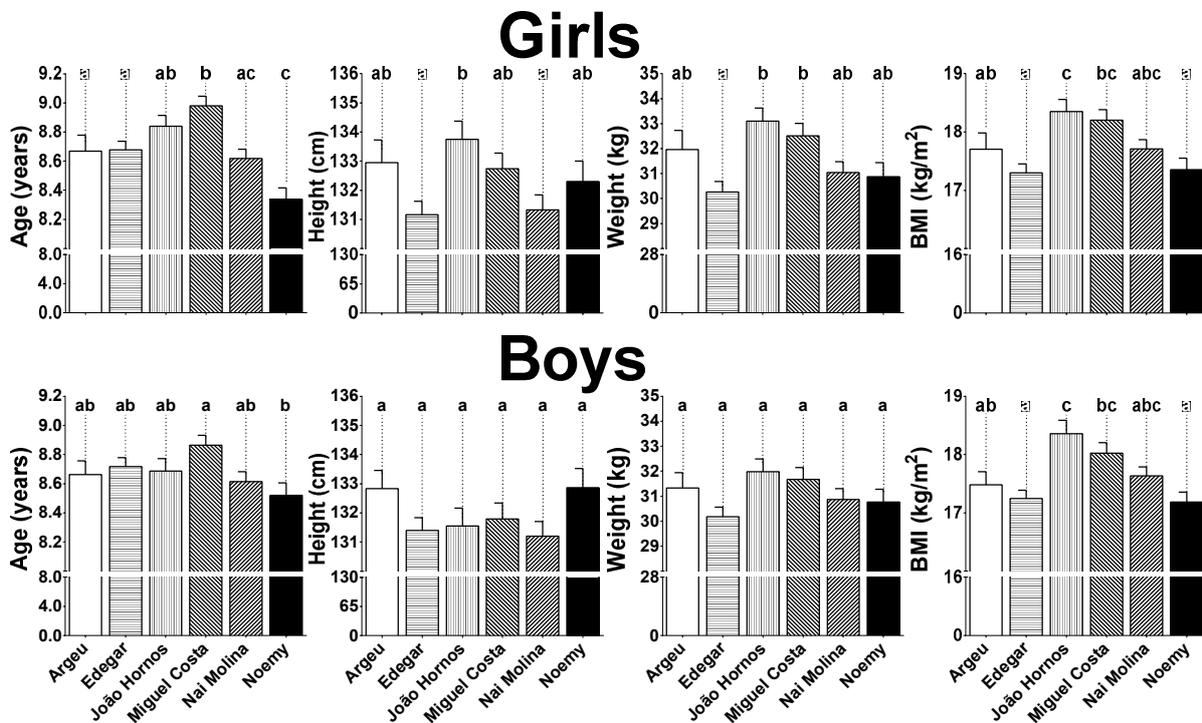


Figure 2. Comparisons between the six schools in relation to age, height, weight and BMI, of girls and boys, in the city of Carapicuíba, Sao Paulo, Brazil. Different lowercase letters (a, b, c) indicate statistically significant differences between schools ($p < 0.05$). Values are expressed as mean ± standard error

In relation to the girls, the Miguel Costa school were significantly older than the others, except for the João Hornos school ($p < 0.05$). Noemy girls were the youngest of all schools ($p < 0.05$). The height of the girls of the João Hornos school was higher than those of the Edegar and Nai Molina schools ($p < 0.05$).

The body weight of the girls at the João Hornos school was higher than in the other schools, except for the Argeu school ($p < 0.05$). Finally, the BMI of the girls of the João Hornos and Miguel Costa schools exceeded the values of the Edegar and Noemy schools ($p < 0.05$).

In relation to boys, only those at the João Hornos school were significantly older and exhibited higher BMI values than those at the Noemy school.

DISCUSSION

The main findings of this study point to a proportional distribution of the sample between the sexes, low prevalence of weight deficit and height for age and high prevalence of overweight, confirming the overweight population data in this age group (Brazil, 2010). In the evaluation of the sexes in each school, only João Hornos showed that the girls were taller. When comparing the variables between the schools and between the sexes Miguel's girls were older than all the schools except João Hornos and Noemy's were the youngest. João Hornos's girls were taller than those of Edegar and Nai Molina and heavier than all other schools except Argeu and, along with Miguel Costa's, had a higher BMI than those of Edegar and Noemy. The boys of John Hornons were older and had a BMI greater than those of Noemy. The João Hornos school is located in the central region of the city of Carapicuíba, which may have influenced the differences between the variables studied, although in a sub-sample of the same study, there was no significant difference between the socioeconomic class of the parents and the nutritional status of the children (Oliveira, Oliveira, Portes, Kutz, & Salgueiro, 2015). Other factors may justify these findings, as pointed out by nutritionists in the municipality, as offering other foods than those served by school meals and the participation of children in celebrations promoted by teachers and managers.

A cross-sectional study of 218 schoolchildren aged 6 to 14 years, from three public elementary schools located in the Parelheiros region, in the metropolitan region of the City of Sao Paulo, 16.5% were overweight and 14.7% were obese, totaling over weight in 31.2% of the children (Fagundes *et al.*, 2008).

It was observed in the study of Jesus (2010), with 261 schoolchildren aged 7 to 9 years, of the municipal school network of Mogi Guaçu - Sao Paulo, that 16.86% presented a high weight for the age, all the students presented adequate height for age and when evaluated according to BMI, 15.7% were overweight, 12.3% were obese and 5.4% were overweight, the prevalence of overweight was 33.3%, presenting prevalences similar to those of the present study. In a study carried out with 337 schoolchildren aged 7 to 10 years, enrolled in the educational network of the city of Colombo - Parana, 98.2% presented adequate height for the age indicating that there are no cases of previous malnutrition in this population. As for BMI for age 16.3% were overweight and 7.3% were obese, totaling 23.6% of overweight (Cutchma *et al.*, 2012). In the present study the prevalence of overweight, obesity and overweight are higher than the aforementioned study, respectively. The early diagnosis of overweight and obesity and other factors in the school environment favor the monitoring and adoption of preventive and educational measures in a timely manner, giving a more favorable prognosis in a more sustained and long-term way involving the school community (Panazzolo *et al.*, 2014). This study shows that in several Brazilian states the prevalence of overweight and obesity in the schoolchildren is similar (Rosaneli *et al.*, 2012). Overweight in childhood and adolescence deserves special attention because it increases the richness of individuals becoming obese in adulthood, thus obtaining a greater chance of developing chronic non-communicable

diseases (Panazzolo *et al.*, 2014). Gilgione, Ferreira, and Bennemman (2011), observed in a study carried out with 8141 students enrolled in the municipality of Maringa - Parana, that when assessed by BMI the majority of the students 59,30% presented adequate weight, nevertheless, 40,70% presented some problem in their nutritional status is due to overweight with 29.8% or risk for low weight and low weight, 10.9%. In Carapicuíba, municipal schoolchildren presented higher prevalences of excess than low weight.

In the study by Rosaneli *et al.* (2012), with 5,037 schoolchildren aged 6 to 10 years from public and private schools in Maringa -Parana, verified in a univariate analysis that the head of household's education, inadequate consumption of carbohydrates, fruits, proteins and the displacement method to the school (car/bus versus foot/bicycle) were determinants of greater chance of being overweight, showing a prevalence of 24%, in the multivariate analysis, male schoolchildren presented a 17% greater chance of overweight compared to schoolchildren female. Regarding school, private schoolchildren presented a 20% greater chance of being overweight than those in public schools; the same happened with children of parents with higher education. Differently from the present study where more than 33% of the students were overweight evaluated by BMI, data much higher than found by Rosaneli *et al.* (2012). It was not possible to establish comparisons in relation to parents' schooling, since it was not the object of evaluation of the present study.

Al-Mohaimed, Ahmed, Dandash, Ismail, and Saquib (2015) conducted a study in Saudi Arabia in two cities with a total of 10 schools with 874 primary schoolchildren, 618 males and 256 females, between 6 and 10 years of age. On average girls were significantly taller and heavier than boys. According to the BMI, the prevalence of overweight and obesity in the sample was 12.4% and 9.9%, respectively. Among boys, the prevalence was 9.5% and 7.8%, and among girls it was 19.1% and 15.2%. In general, the combined prevalence of overweight was significantly higher among girls than among boys (34.3% versus 17.3%). In the present study, the prevalence of overweight assessed by BMI/A was similar between girls and boys, which was different from the previous study. In relation to one of the schools studied, João Hornos, it is noticed that the girls are taller and heavier than the boys, which is similar to the study of Al-Mohaimed *et al.* (2015). He *et al.* (2014) carried out a cross-sectional study in the Wannan area of China with 67,956 schoolchildren, 36,664 boys and 31,292 girls, from primary schools aged 5 to 14 years. The prevalence of overweight in the sample was 17.85%, among boys 22.9% and among girls 11.9%. These results are different from those found among schoolchildren in Carapicuíba schools. A study conducted in four rural regions of the United States being them; California (Central Valley), Kentucky (Appalachia), Mississippi (Delta), and South Carolina, which were selected by Save the Children for the high poverty rate, evaluated 410 children ages 6 to 10. Of the 45 participants in Kentucky, nearly 60% were overweight, in California, 152 children, 50% were overweight in South Carolina, 73 children, 44% were overweight and finally 131 children from Mississippi, 37% were overweight (Tovar *et al.*, 2012). The prevalence of overweight among schoolchildren in the municipal schools of Carapicuíba is similar to the results found in Mississippi, but lower than the findings of other rural areas of the United States, reinforcing the need for intervention measures for urgent lifestyle changes.

The present study was the first one on nutritional evaluation of schoolchildren from the municipal schools of Carapicuíba, who quantitatively presented their nutritional conditions, aiming at the adoption of measures of control and monitoring of nutritional status for the possible improvement of the quality of life of individuals and their families. These findings are in line with the recommendations of the National School Feeding Program (PNAE), which aims to contribute to biopsychosocial growth and development, learning, school performance, monitoring of nutritional status and formation of healthy habits of schoolchildren by means of actions of Food and Nutritional Education (FNE) and the provision of meals that cover their nutritional needs during the period in which they remain in school. The PNAE guides the use of varied, safe foods that respect healthy food culture, traditions and eating habits, contributing to the growth and development of schoolchildren and to improving school performance, according to their age group and their health status, including those in need of specific attention (Brazil, 2014). According to the Food and Nutrition Education Reference Framework for Public Policies, FNE needs to be present throughout the course of life responding to the different demands that the individual presents, from the formation of dietary habits in early childhood to the organization of their out-of-home adolescence and adulthood (Brazil, 2012). Thus, public health promotion policies and the implementation of government actions can positively influence individuals' ability to make healthy food choices (Brazil, 2013). The school offers an important environment for carrying out FNE actions for the promotion of health, and can have a positive impact on health, self-esteem, behaviors, development of skills and healthy habits for all members of the school community (Brazil, 2008).

CONCLUSION

The present study found a high prevalence of overweight among schoolchildren in the municipal schools of Carapicuíba. The school, through menus offered in school meals, in line with the recommendations of the PNAE, could offer educational actions directed to the promotion of healthy eating habits and health promotion, respecting and valuing the cultural and regional specificities of the different groups that impacted these prevalence.

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